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AN ANALYSIS OF PROJECT PERFORMANCE FOR PARTNERING PROJECTS IN THE U. S. ARMY CORPS OF ENGINEERS

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AN ANALYSIS OF PROJECT PERFORMANCE FOR PARTNERING PROJECTS IN THE U. S. ARMY CORPS OF ENGINEERS

by

DAVID CHARLES WESTON, B.S.

THESIS

Presented to the Faculty of the Graduate School of

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MASTER OF SCIENCE IN ENGINEERING

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Date Submitted: November 11, 1992

ABSTRACT

AN ANALYSIS OF PROJECT PERFORMANCE FOR PARTNERING PROJECTS IN THE U. S. ARMY CORPS OF ENGINEERS

by

DAVID CHARLES WESTON, B.S.

SUPERVISING PROFESSOR: G. EDWARD GIBSON, JR.

This thesis presents an analysis of project performance for partnering projects in the U. S. Army Corps of Engineers. Partnering in engineering and construction usually involves an agreement between an owner and contractor to work together for an extended period of time, over several consecutive contracts. Because of legal regulations, the Corps of Engineers is unable to establish long-term partnering relationships, but has been successful in implementing partnering on a project-by-project basis. The Corps of Engineers has not yet attempted to measure quantitatively their success in this area. This thesis compares the project performance of a sample of partnering projects with a similar sample of non-partnering projects. The criteria used for comparison are cost, duration, change orders cost, claims cost, and value engineering savings. Conclusions and recommendations are presented based on the results of the analysis.

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1. Introduction

1.1. Purpose.

The purpose of this thesis is to analyze the project performance of U. S. Army Corps of Engineers projects that have used a partnering approach to project management. Some individual districts within the Corps of Engineers have gauged their own partnering project performance. To date, this is the first attempt at an in-depth, Corps-wide study. This analysis will attempt to show whether partnering projects perform better on average than a sample of non-partnering, Corps of Engineers projects. This thesis will also present partnering perceptions from Corps' project managers and construction contractors to gauge their satisfaction with their partnering experience.

1.2. Scope.

This thesis will analyze 16 of the 19 partnering projects completed by the Corps of Engineers at the time of this study. The criteria for measuring project performance will be standard Corps' data maintained for tracking project performance (criteria are discussed in detail in Chapter 3). Those criteria will be used to develop a comparison between the partnering projects and a sample of similar non-partnering projects collected for this study. Additional subjective data for the partnering projects will be obtained through interviews with selected Corps' project managers and contractors for those projects. These interviews will be examined to determine the views of both parties towards their experience

with the partnering process. Perceptions are important because for a partnering experience to be a true success, both parties must come away with a feeling of satisfaction. Additionally, other intangible positive and negative partnering factors may be perceived through these interviews.

2. Background

2.1. Partnering Defined.

Partnering is a relatively new term to the construction industry and an even newer term to the Corps of Engineers. The term partnering defines a relationship that exists between a customer and supplier. In the construction industry, this relationship normally exists between the owner and a contractor. Partnering relationships may also exist between owners and architects, contractors and suppliers, etc. A Construction Industry Institute (CII) task force established in 1987 to evaluate partnering defined it as (CII 1991):

> . . . a long term commitment between two or more organizations for the purpose of achieving specific business objectives by maximizing the effectiveness of each participant's resources. This requires changing traditional relationships to a shared culture without regard to organizational boundaries. The relationship is based upon trust, dedication to common goals, and an understanding of each other's individual expectations and values. Expected benefits include improved efficiency and cost effectiveness, increased opportunity for innovation, and the continuous improvement of quality products and services.

Out of that definition, the task force identified three key elements; trust, shared vision, and long term commitments.

That definition applies well to private sector construction. It applies equally as well to public sector construction with the exception of establishing long term commitments. Regulatory requirements for public agencies, such as the Corps of Engineers, require, with few exceptions, the use of a full and open,

competitive, low bid contracting strategy for construction projects (F. A. C. 1985). Therefore, public agencies are not able to establish the sort of long term relationships that are essential to partnering in the private sector.

2.1.1 Private Sector Partnering.

In private sector construction, partnering refers to a long term agreement between two companies to achieve an unusually high degree of cooperation between the two parties to accomplish separate yet complementary objectives. Private sector partnering usually involves some agreement between an owner and contractor, design firm, or supplier, to work together for an extended period of time, over several consecutive contracts. This long term agreement allows the two parties to work more effectively and efficiently. Both parties benefit from better workload stability and reduced overhead, as well as improved cost, quality, and schedule performance. The long term relationship is considered critical to partnering success because it generates an atmosphere that lends itself to problem solving, frees each partner from constant reevaluation, and permits "lessons learned" to be passed from one project to the next. Inherent in such a long term relationship is a build-up of mutual trust that breaks down the traditional adversarial relationship between owner and constructor (CII 1991).

2.1.2. Corps of Engineers Partnering.

Although the Corps of Engineers is unable to establish long term relationships with construction contractors, there have been nineteen projects

completed under a project partnering agreement concept, with eighty-five projects ongoing or scheduled to start. The Corps defines partnering as the creation of a relationship between the owner, the contractor and his/her subcontractors that promotes mutual and beneficial goals. It is a non-contractual, but formally structured agreement between the parties leading to an attitude that fosters risk sharing. The central objectives of partnering are to avoid disputes and to encourage contracting parties to change their traditional adversarial relationships to a more cooperative, team-based approach.

The creation of teamwork through partnering allows the project players to focus on issues affecting the project performance as well as issues affecting the project team relationship. Major James S. Weller, Deputy Area Engineer, Rocky Mountain Area Office, Omaha District, 1992, provided a "Team Management Styles" diagram used in one of their partnering workshops. The diagram expresses the behavioral tendencies of team members and their ability to focus on issues and team relationships at different levels of cooperation. The diagram is shown in Figure 1.

The Corps of Engineers believes that the benefits of successful partnering relations include: avoidance of disputes; improved communication; increased quality and efficiency; on-time performance; improved long term relationships; and a fair profit and prompt payment for the contractor (Carr, et al. 1991). The ultimate goal is to eliminate the "us" versus "them" thinking, and form a "we" mentality for the benefit of the project.

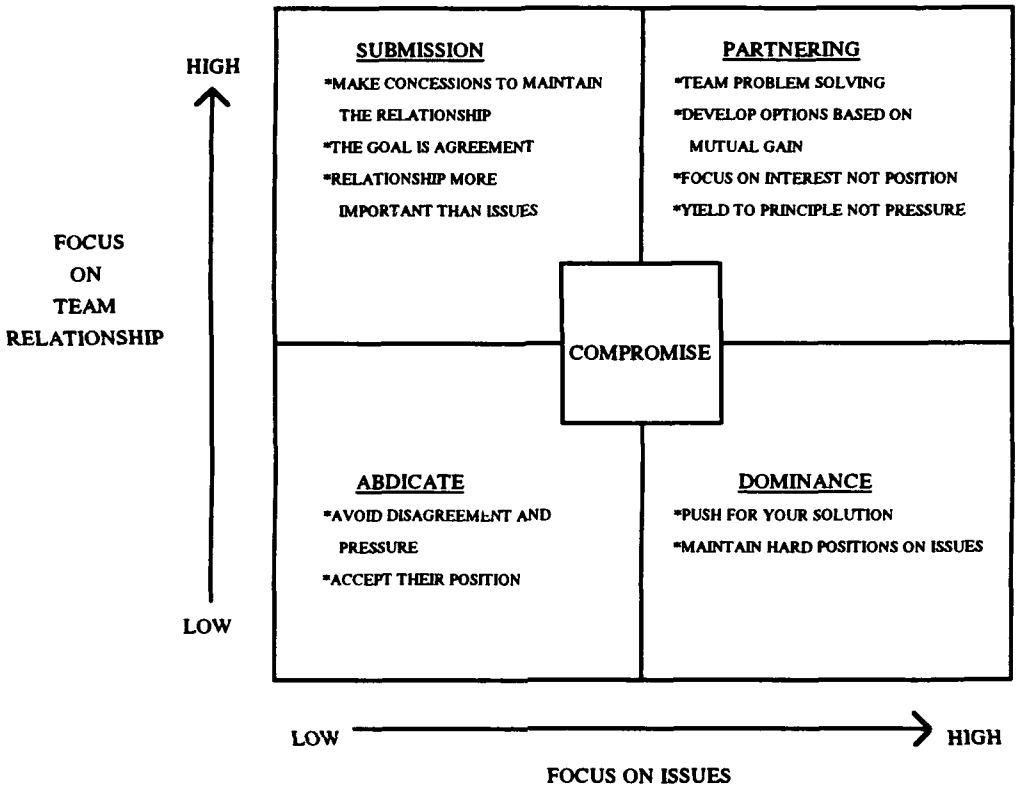

Figure 1. Team Management Styles

The Corps does not require contractors to enter into a partnering agreement as part of the contract. It is strictly a voluntary decision. When the solicitation for bids is sent out, it is accompanied by a general statement such as this one used by the Mobile District (Mobile 1990):

> In order to most effectively accomplish this contract, the Government proposes to form a cohesive partnership with the Contractor and its subcontractors. This partnership would strive to draw on the strengths of each organization in an effort to achieve a quality project done right the first time, within budget and on schedule. This partnership would be bilateral in make-up and participation will be totally voluntary. Any cost associated with effectuating this partnership will be agreed to

> by both parties and will be shared equally with no change in contract price.

The key concepts in the statement are "voluntary" and "cost sharing". The process of partnering should be one that both parties want and for which both are willing to pay.

Partnering is normally established through a facilitated process consisting of organized workshops attended by key participants from both parties to the contract. An outside facilitator is usually hired to lead the workshop. The process is designed to create a structured environment that develops the cooperative attitude and commitment needed to drive the partnering agreement. A normal workshop lasts for two to three days. For small, less complex projects, an in-house facilitator may be used. This approach probably should be avoided however, because it is imperative that both parties see the facilitator as a neutral party to the process. At the completion of the workshop, a partnering agreement is drafted and signed by all participants of the workshop. Included in that agreement is a list of common project goals agreed to by all participants (Appendix A shows examples of partnering agreements between the Corps of Engineers and different entities).

Several key elements to establishing a successful partnering relationship have been identified. These include: (1) early start; (2) commitment from top management on both sides; (3) appointment of a partnering representative on both sides; (4) selection of participants for the workshop(s); (5) selection of facilitator(s); (6) scheduling the workshop(s); (7) conducting the workshop(s); and (8) follow-up workshops (Mobile 1990).

The last item is considered crucial. The initial workshops have proven effective in establishing the partnership; however, as time goes on, people tend to slip back into their old ways of doing business. Follow-up workshops or meetings need not be as formal as the first workshop, but need to occur at regular intervals to evaluate and reestablish the partnering commitment necessary from both parties. The frequency depends upon the individual personalities and circumstances of the project (Mobile 1990).

The cost of the partnering workshop (less the time/labor costs of the individuals in attendance) is shared equally between the Corps of Engineers and the contractor, or other agency. The cost of a partnering workshop varies from project to project. Factors contributing to the total cost are cost of facilitator, cost of facilities, cost of time for personnel in attendance, and cost of administrative support. An estimate for the cost of an initial partnering workshop for an $8.3 million project currently under construction in the Wilmington District is shown below (Kadala 1992).

- Cost of facilitator (shared) - $2500.
- Cost of meeting room and refreshments (shared) - $100.
- Temporary Duty (TDY) costs for participants based on the government TDY rate for the area of $83.00 per day for 1.5 days and 14 participants (7 government and 7 contractor) - approximately $1,750.
- Labor costs for 14 participants based on the pay rate for a GS-12 Engineer ($400 per day), including travel time - $11,000.

- Total workshop cost - $15,350, or $7675 for government and contractor. The total cost is approximately 0.18% of the contract award price.

Although costs may vary greatly from project to project, this provides a good approximation for the cost of an initial partnering workshop. The cost of follow-up workshops can be similar or less depending on whether or not a facilitator is used, the location of the workshop and the format of the workshop.

The keys to maintaining the partnering relationship throughout the project duration are: (1) objectives must be specific and carefully monitored, (2) a problem escalation/resolution process must be established, (3) progress must be evaluated jointly, (4) partnering skills must be encouraged and developed, and (5) executives must be involved in the process (Cowan 1991).

2.2. Evolution of Corps Partnering.

In the past, the atmosphere of Corps of Engineers projects could only be characterized as an adversarial relationship between all parties concerned. The adversarial management relationship jeopardizes the ability of either side to realize its expectations. The result is an upward spiral of risk and cost: risk of contractors going out of business, risk of projects failing to meet schedule, and risk of significant cost overruns. Much of the taxpayer's money does not go to productive facilities, but instead to increased overhead, litigation, and contesting experts. To overcome the negative impacts of adversarial relationships, the Corps (particularly certain districts within the Corps) has looked to partnering as one solution to the problem (Carr, et al. 1991).

As stated above, partnering is a relatively new concept to the Corps of Engineers. The two Corps' districts with the most partnering experience are Mobile and Portland. The first partnering project began in the Mobile District. The project, the Oliver Lock and Dam Replacement, located on the Black Warrior-Tombigbee Waterway at Tuscaloosa, Alabama, began on 1 April 1988 (Mobile 1990). Portland's first partnering project began in early 1989, and involved the construction of diaphragm retaining walls at the Bonneville lock site on the Columbia River (Jones 1991). To date, 19 partnering projects have been completed in nine districts. Another 85 partnering projects are currently ongoing or scheduled to start.

The Corps of Engineers is also putting more emphasis on partnering. The Corps conducted an executive seminar on partnering on 24-25 October 1991, to focus the Corps' leadership on the applicability of partnering within their districts. All Corps division and district commanders attended (Office of the Chief Counsel 1991). In addition to partnering with construction contractors, the Corps is looking at ways to apply partnering to every phase of its construction projects. LTG H. J. Hatch, former commander of the Corps of Engineers, stated in his policy memorandum, dated February 18, 1992 (shown in Appendix B), "Therefore, it is the clear policy of the Corps of Engineers to develop, promote and practice partnering on all construction contracts, and to universally apply the concept to all other relationships." Clearly, partnering is becoming expected on Corps of Engineers' construction projects.

Three types of project partnering efforts are available for the districts to undertake. The obvious choice for partnering is between the Corps of Engineers and its construction contractors. Some districts are also setting up partnering arrangements between themselves and other governmental agencies for the purposes of sharing goals and expediting project identification and completion. Another possibility, as yet untried, is for a district to create a partnering arrangement with design firms for the purpose of performing feasibility analysis and detailed design of a project. The recent policy statement by LTG Hatch seems to indicate that all three areas will be addressed in the future by Corps of Engineers' districts.

Other public owners are trying partnering on their projects. One example is the Anaheim Arena under construction in Anaheim, California. All participants in the project are satisfied with their partnering experience. Gary E. Johnson, city engineer and director of public works, feels that, "It is by far the best project I've worked on in 23 years." The project executive for the general contractor, Robert S. Aylesworth stated, "I was pretty skeptical of partnering but now am a believer." (Post 1992) The General Services Administration is also using partnering for construction of a new National Archives building. The strategy of team building has paid off, with strong bonds forming between project officials from the Archives, GSA, and the design and construction team. The job is currently on schedule for its July 1993 opening date and within its $250 million budget. Clearly, partnering is a valid quality project management initiative for the future of public sector construction (Ichniowski 1992).

3. Research Methodology

3.1. Data Gathering.

Data collection for this project was performed through a combination of written requests for information, telephone interviews and a visit to the Galveston District headquarters in Galveston, Texas. Letters were mailed to each of the 37 U. S. Army Corps of Engineers districts requesting the status of partnering within each district, and project performance data for projects completed under formal partnering agreements. Data for similar non-partnering projects were collected as well. A copy of the solicitation letter is shown at Appendix C. Telephone interviews provided subjective data from contractors and Corps' project managers involved with partnering projects. The visit to the Galveston District headquarters allowed the author to determine what categories of project information are routinely recorded by the Corps of Engineers at project completion. This determined the specific categories of data to be collected and used to evaluate the performance of partnering projects.

3.1.1. Partnering Project Data.

A survey of districts was conducted to determine the status of partnering in the 37 domestic Corps' districts. Specific information to be gained from this survey included: (1) the percentage of districts using partnering on their construction projects; (2) the types of partnering used in each district; (3) the number of completed partnering projects; and (4) the number of partnering

projects under construction. Those districts with completed partnering projects were asked to supply project data for those projects. The data requested were contract award price, final project cost, original project duration at time of contract award, final project duration, change order cost, claims cost, and value engineering savings.

3.1.2. Non-partnering Project Data

A sample of comparison projects that were not completed under a formal partnering agreement was collected. The same districts that had completed partnering projects were asked to provide data for non-partnering projects that were similar in scope and dollar amount to the partnering projects. The author attempted to achieve a ratio of three non-partnering projects to one partnering project from each district. In some cases, this was not feasible, and data from non-partnering projects from other districts that were similar in scope and dollar amount were collected to attempt to achieve statistical validity of the comparison sample.

3.1.3. Subjective Data.

Telephone interviews were conducted with selected Corps' project managers and contractors to determine the views of both parties towards their experience with the partnering process. Individuals were confidentially interviewed to gain candid comments, both positive and negative, on their

perspectives concerning the success of the partnering relationship, and the impact of partnering on project performance.

3.2. Analysis Methods.

The collection of project performance data allows for a quantitative analysis of the performance of partnering projects versus non-partnering projects. The personal interviews provide subjective data that are helpful in analyzing the perceptions of Corps' project engineers and contractor representatives with partnering experience.

3.2.1. Project Data Analysis

The criteria used for measurement are standard Corps of Engineers data maintained for tracking project performance (cost, cost of change orders, cost of claims, value engineering savings and schedule). These data are then normalized as a percentage of total original construction award cost or duration. The criteria are then used to develop a comparison between the partnering projects and a database of similar non-partnering projects using the mean value for each criterion. An analysis of means will be used to determine if statistical validity has been achieved.

3.2.2 Subjective Data Analysis.

The subjective data collected from interviews with Corps' project engineers and contractors will be used to assess the validity of the partnering relationships established by the formal partnering agreements. An effort will be

made to determine if the "win-win" atmosphere of partnering is actually profitable for both parties. Barriers to partnering identified during the interviews will also be presented.

4. Presentation of Data

4.1. Survey of Districts.

A survey of the 37 domestic Corps of Engineers districts was undertaken as part of this research effort. Table 1 shows the current state of partnering in each district. Note that column (1) lists the 37 districts and column (2) indicates the districts that are partnering. Columns (3), (4), and (5) show which of the three types of partnering relationships are being pursued. Columns (6) and (7) show the status of projects completed or being performed by individual districts using partnering. Most of the ongoing projects have been started within the past eighteen months.

Currently, 31 of 37 domestic Corps of Engineers districts are using formalized partnering agreements. Twenty-eight of the districts are partnering with construction contractors only, one district is only partnering with other governmental agencies, and two districts are partnering with both contractors and other governmental agencies. None of the districts are currently partnering with design firms. Figure 2 graphically shows the status of partnering implementation.

Table 1. Status of Partnering in Districts

DISTRICT (1)	PARTNERING (2)	DESIGN FIRMS (3)	CONSTRUCTION CONTRACTORS (4)	INTERAGENCY PARTNERING (5)	PROJECTS COMPLETED (6)	PROJECTS ONGOING (7)
ALASKA	Y	N	Y	N	0	1
ALBUQUERQUE	Y	N	Y	N	3	0
BALTIMORE	Y	N	Y	N	0	1
BUFFALO	Y	N	Y	N	0	3
CHARLESTON	Y	N	Y	N	0	1
CHICAGO	N	N	N	N	0	0
DETROIT	N	N	N	N	0	0
FORT WORTH	Y	N	Y	N	0	2
GALVESTON	Y	N	N	Y	0	0
HONOLULU	Y	N	Y	N	0	1
HUNTINGTON	Y	N	Y	N	1	0
JACKSONVILLE	Y	N	Y	N	1	1
KANSAS CITY	Y	N	Y	N	0	4
LITTLE ROCK	Y	N	Y	N	0	1
LOS ANGELES	Y	N	Y	N	0	11
LOUISVILLE	N	N	N	N	0	0
MEMPHIS	Y	N	Y	N	1	0
MOBILE	Y	N	Y	N	2	4
NASHVILLE	Y	N	Y	N	0	1
NEW ORLEANS	Y	N	Y	N	0	1
NEW YORK	Y	N	Y	N	0	1
NORFOLK	Y	N	Y	N	0	2
OMAHA	Y	N	Y	N	0	2
PHILADELPHIA	Y	N	Y	N	0	1
PITTSBURGH	Y	N	Y	N	0	2
PORTLAND	Y	N	Y	N	2	0
ROCK ISLAND	N	N	N	N	0	0
SACRAMENTO	N	N	N	N	0	0
ST LOUIS	Y	N	Y	Y	0	4
ST PAUL	Y	N	Y	Y	0	4
SAN FRANCISCO	N	N	N	N	0	0
SAVANNAH	Y	N	Y	N	2	9
SEATTLE	Y	N	Y	N	0	1
TULSA	Y	N	Y	N	1	20
VICKSBURG	Y	N	Y	N	0	2
WALLA WALLA	Y	N	Y	N	6	3
WILMINGTON	Y	N	Y	N	0	2
TOTALS(37)	31	0	30	3	19	85

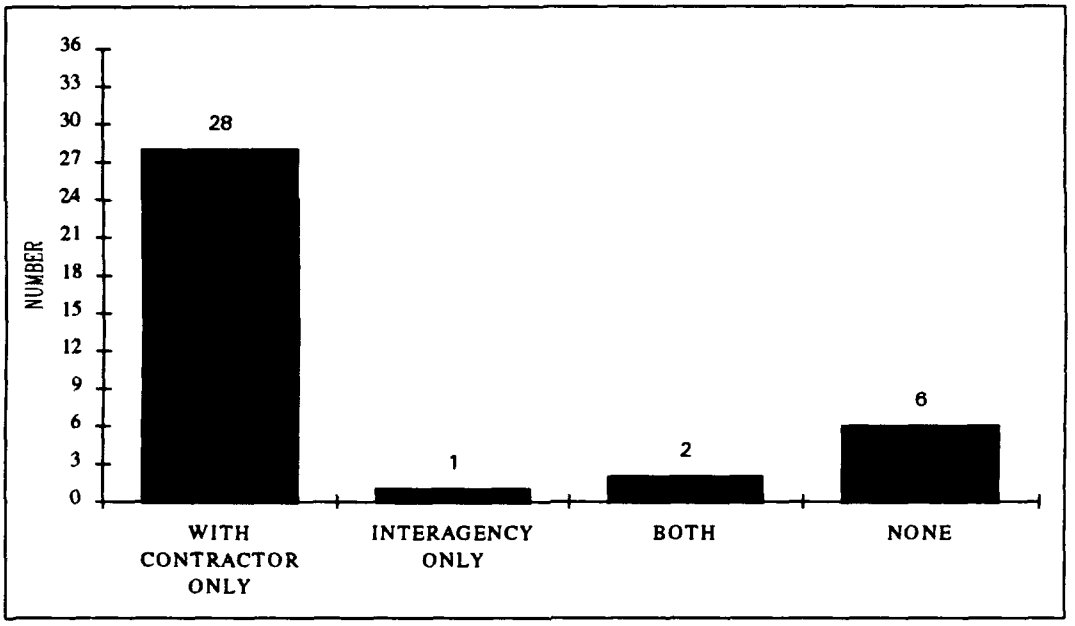

Figure 2. District Partnering Programs by Type

4.2. Partnering Projects.

The survey of districts revealed that nineteen partnering projects have been completed in nine districts. Table 2 shows these districts and the total completed partnering projects for each.

Table 2. Districts With Completed Partnering Projects

DISTRICT (1)	COMPLETED PROJECTS (2)
ALBUQUERQUE	3
HUNTINGTON	1
JACKSONVILLE	1
MEMPHIS	1
MOBILE	2
PORTLAND	2
SAVANNAH	2
TULSA	1
WALLA WALLA	6
TOTAL	19

The author was able to obtain data for 16 of the 19 projects, from seven of the nine districts. The project data for those projects are shown at Appendix D. Table 3 shows the 16 projects listed in order of descending contract award price. Column (3) identifies the project as either military or civil works construction.

Table 3. Partnering Projects

PROJECT NUMBER (1)	ORIGINAL COST (2)	TYPE M/C (3)	PROJECT DISTRICT (4)
1	$33,900,000	C	PORTLAND
2	$22,798,000	M	SAVANNAH
3	$15,575,000	C	HUNTINGTON
4	$15,471,840	C	WALLA WALLA
5	$12,655,385	M	ALBUQUERQUE
6	$10,258,000	C	WALLA WALLA
7	$ 8,323,045	C	JACKSONVILLE
8	$ 7,097,911	C	WALLA WALLA
9	$ 7,049,000	C	WALLA WALLA
10	$ 5,748,520	C	SAVANNAH
11	$ 5,356,000	C	WALLA WALLA
12	$ 5,058,000	M	ALBUQUERQUE
13	$ 4,990,000	C	PORTLAND
14	$ 4,657,212	M	ALBUQUERQUE
15	$ 3,321,250	C	WALLA WALLA
16	$ 1,551,340	C	MEMPHIS
AVERAGE	$10,238,156		

Of the 16 projects, 12 (75%) are civil works construction projects, while four (25%) are military construction projects. The contract award price for partnering projects ranges from a low of $1,551,340 to a high of $33,900,000. The average contract award price for the partnering projects is $10,238,156.

The criteria for measuring project performance are cost change, change orders cost, claims cost, value engineering savings and duration change. Each criterion is normalized as a percentage of either original contract award price, or original schedule duration. Table 4 shows the normalized criteria for each partnering project. The projects are arranged in descending order with respect to cost change.

Table 4. Partnering Project Performance

PROJECT NO. (1)	%COST CHANGE (2)	%DURATION CHANGE (3)	%C/O COST (4)	%CLAIMS COST (5)	%VALUE ENGR (6)
1	15.17	3.66	15.17	0.00	0.00
2	9.55	0.00	9.55	0.00	0.18
3	9.04	20.86	10.44	0.00	0.17
4	7.08	0.00	7.08	0.00	5.01
5	7.04	6.20	1.01	0.00	0.00
6	6.47	29.00	0.39	0.00	0.00
7	4.74	12.50	4.74	0.00	0.00
8	4.58	10.59	0.27	0.00	0.00
9	3.46	-0.98	3.51	0.00	0.00
10	2.67	2.67	2.56	0.00	0.68
11	2.40	1.56	1.97	0.00	0.00
12	1.81	7.67	0.11	0.09	0.00
13	0.99	19.63	0.99	0.00	0.00
14	0.70	-2.68	1.25	10.63	0.55
15	-4.61	-6.78	4.61	0.00	0.94
16	-9.40	41.30	-1.28	0.00	4.19
AVERAGE	3.86	9.08	3.90	0.67	0.73
VARIANCE	30.59	155.76	19.33	6.61	2.24

The average cost growth for partnering projects is 3.86%. The average schedule growth is 9.08%. The cost of change orders averaged 3.90% of the original contract award price. Claims costs averaged 0.67%, and value

engineering savings averaged 0.73%. The author will use these results to compare the performance of partnering projects with a sample of non-partnering projects. The sample mean will be used for a T-test comparison of means between the partnering projects and a sample of non-partnering projects. Figures 3, 4, 5, 6, and 7 show a graphical representation of the data, organized in descending order, for each criterion shown in Table 4.

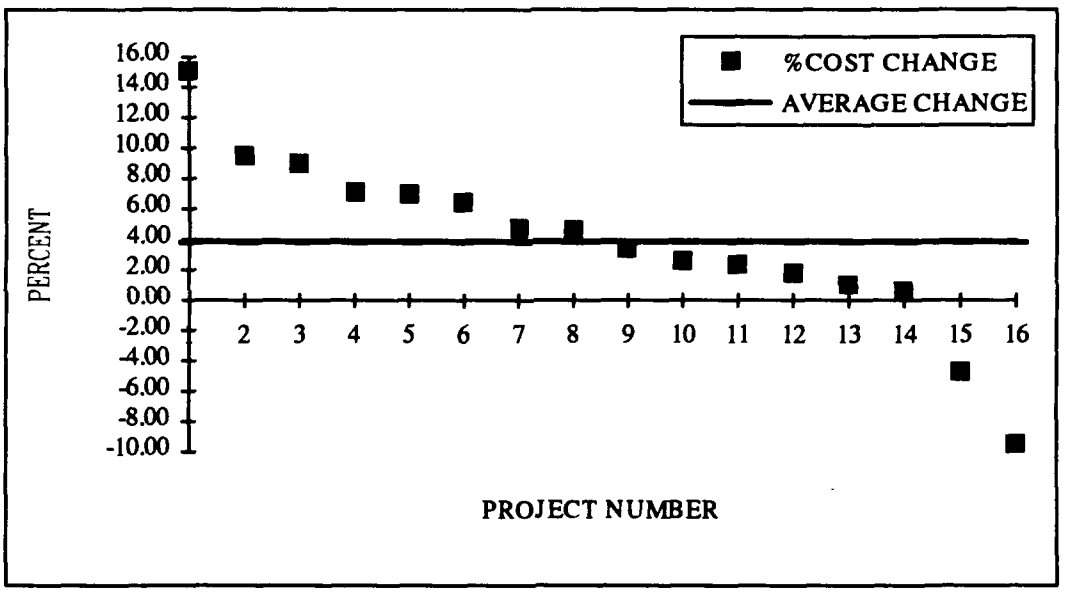

Figure 3. Partnering Project % Cost Change

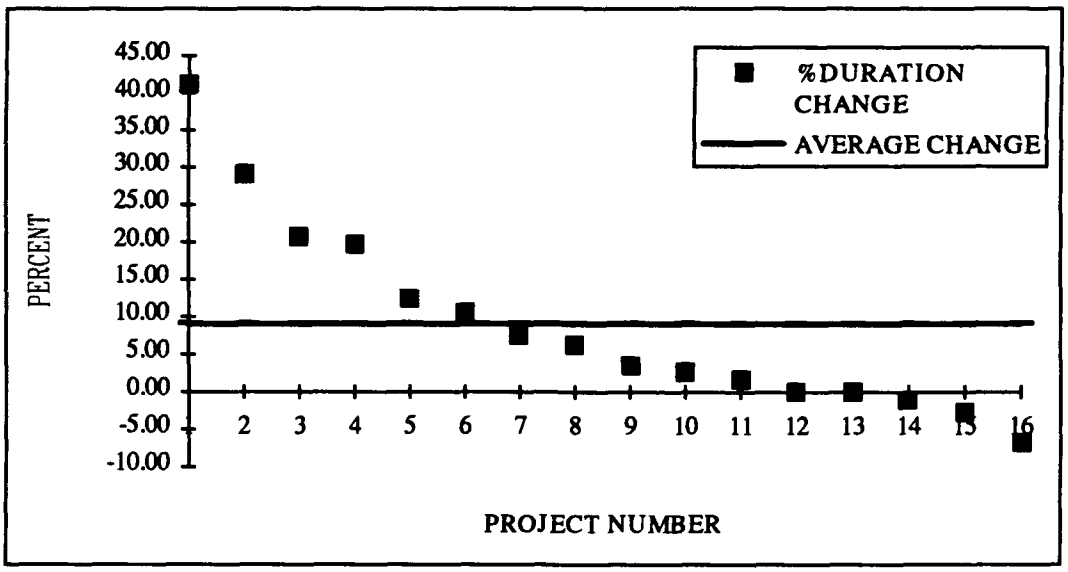

Figure 4. Partnering Project % Duration Change

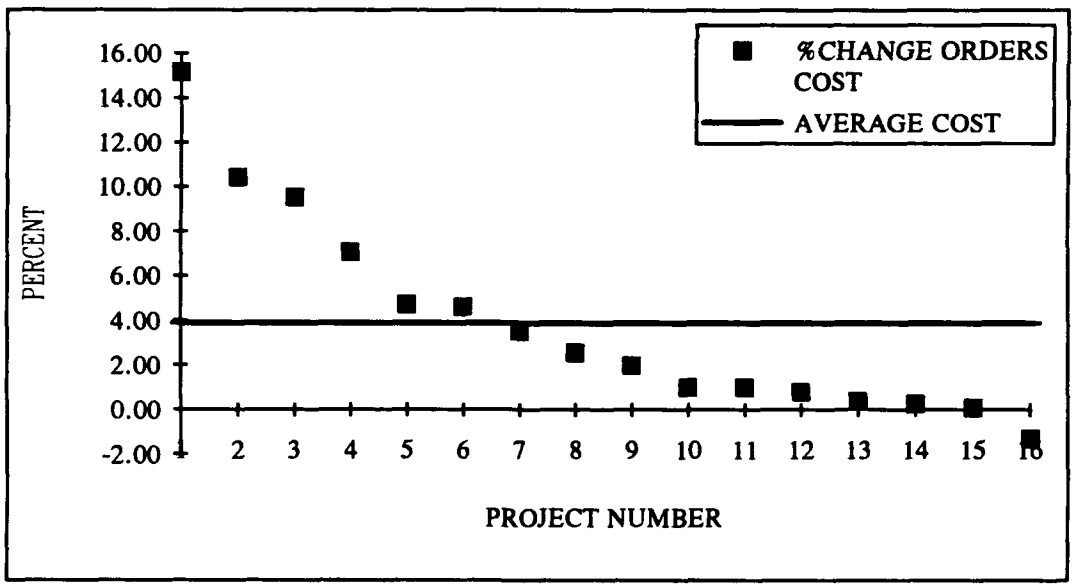

Figure 5. Partnering Project % Change Orders Cost

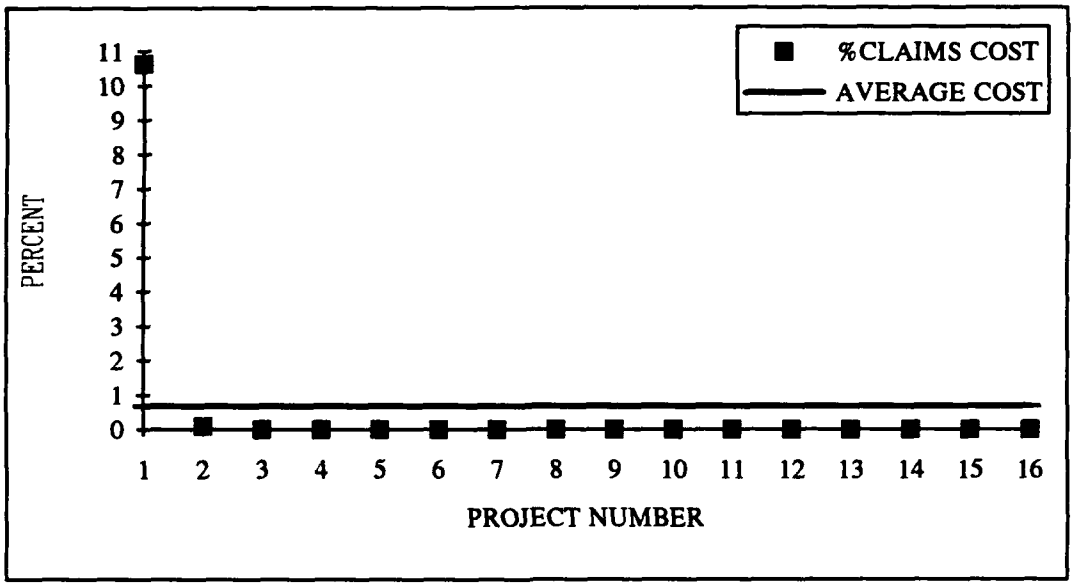

Figure 6. Partnering Project % Claims Cost

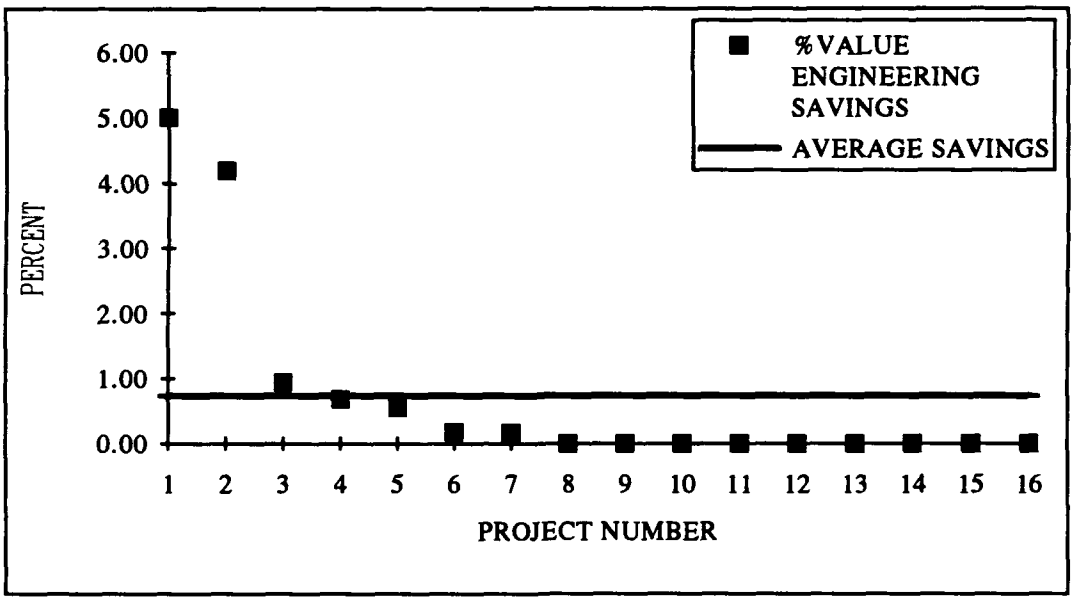

Figure 7. Partnering Project % Value Engineering Savings

4.3 Non-Partnering Projects.

The author attempted to obtain Corps wide averages for the criteria used to measure project performance. This was not feasible, as the Corps of Engineers does not collect and track individual project data at the Corps of Engineers headquarters level (Krull 1992). Therefore, a sample of non-partnering projects was collected from various districts. The performance of the projects in this sample may not accurately represent project performance on a Corps-wide basis. A t-test comparison of means will be performed in Chapter 5 to determine if the sample of non-partnering projects is statistically the same as the sample of partnering projects.

Eight districts contributed project data for 39 non-partnering projects. From those 39 projects, 29 were selected for use as comparison projects. Of those 29 projects, 13 were selected because they came from the same districts as the partnering projects. The remaining 16 projects were selected because they fell within a range of $1-33 million, which is the same range as that of the partnering projects. Projects with more than one criterion that fell well above the sample mean were omitted (one project). The project data for those 29 projects are shown at Appendix E. Table 5 shows the 29 projects listed in order of descending contract award price. Column (3) identifies the project as military or civil works construction.

Table 5. Non-Partnering Projects

PROJECT NO. (1)	ORIGINAL COST (2)	TYPE M/C (3)	PROJECT DISTRICT (4)
1	$56,490,000	C	PORTLAND*
2	$41,887,000	C	HUNTINGTON*
3	$33,706,326	M	FORT WORTH
4	$32,646,896	M	ALBUQUERQUE*
5	$28,050,000	C	PORTLAND*
6	$24,640,375	C	HUNTINGTON*
7	$15,884,618	C	NEW ORLEANS
8	$15,424,900	C	NEW ORLEANS
9	$7,369,295	C	NEW ORLEANS
10	$5,770,000	M	LITTLE ROCK
11	$5,739,250	M	ALBUQUERQUE*
12	$5,627,520	C	BUFFALO
13	$5,194,469	C	BUFFALO
14	$4,938,000	M	ALBUQUERQUE*
15	$4,666,000	M	LITTLE ROCK
16	$4,312,364	M	ALBUQUERQUE*
17	$3,744,000	C	NEW ORLEANS
18	$3,539,944	M	ALBUQUERQUE*
19	$3,333,000	C	BUFFALO
20	$2,883,735	C	JACKSONVILLE*
21	$2,866,500	M	ALBUQUERQUE*
22	$2,851,214	M	ALBUQUERQUE*
23	$2,359,000	M	LITTLE ROCK
24	$2,084,290	C	BUFFALO
25	$2,063,590	C	BUFFALO
26	$1,764,000	M	LITTLE ROCK
27	$1,708,000	M	LITTLE ROCK
28	$1,359,515	C	BUFFALO
29	$321,696	C	ALBUQUERQUE*
AVERAGE	$11,145,707		*=PARTNERING DISTRICT

Of the non-partnering projects, 16 (55%) are civil works construction projects and 13 (45%) are military construction projects. The contract award

price for non-partnering projects ranges from a low of $321,696 to a high of $56,490,000. The average contract award price is $11,145,707.

As with the partnering projects, the criteria of cost change, duration change, change orders cost, claims cost and value engineering savings were normalized with respect to either original contract award price or original duration. Table 6 shows the normalized criteria for each non-partnering project. The projects are arranged in descending order with respect to cost change.

Table 6. Non-Partnering Project Performance

PROJECT NO. (1)	%COST CHANGE (2)	%DURATION CHANGE (3)	%C/O COST (4)	%CLAIMS COST (5)	%VALUE ENGR (6)
1	103.92	47.53	103.92	0.00	0.00
2	29.56	-32.03	29.56	9.17	0.19
3	27.85	26.64	27.85	0.00	0.00
4	25.28	125.83	25.28	0.00	0.00
5	23.01	-36.69	23.01	0.00	0.00
6	22.54	38.89	7.57	14.97	0.00
7	20.57	55.18	14.43	3.73	0.00
8	13.16	19.00	0.79	0.00	0.00
9	12.03	0.00	12.08	0.00	0.05
10	12.02	-36.69	12.02	0.00	0.00
11	11.27	42.09	11.27	47.47	0.00
12	8.90	46.29	8.90	0.00	0.00
13	7.68	23.61	7.54	0.00	0.00
14	7.56	6.70	7.56	9.61	0.00
15	7.29	3.98	4.50	1.29	0.00
16	6.45	11.67	0.39	0.00	0.00
17	6.13	16.75	0.37	4.57	0.00
18	5.44	0.00	5.44	36.70	0.00
19	4.80	46.34	4.80	0.00	0.00
20	4.67	-9.83	4.67	0.32	0.40
21	3.65	18.52	3.65	0.00	0.00
22	3.34	1.78	0.13	12.77	0.00
23	3.18	20.00	0.19	0.00	0.00
24	2.93	-1.48	0.31	0.00	0.00
25	2.42	2.78	0.15	0.00	0.00
26	1.97	11.11	1.97	0.00	0.00
27	1.84	6.73	2.29	0.00	0.69
28	-0.92	27.62	0.13	0.00	0.00
29	-2.23	0.00	-0.04	0.26	0.00
AVERAGE	12.98	16.63	11.06	4.86	0.05
VARIANCE	369.62	975.80	381.54	121.25	0.02

The average cost growth for non-partnering projects is 12.98%. The average schedule growth is 16.63%. The cost of change orders averaged 11.06% of the original contract award price. Claims costs averaged 4.86%, and

value engineering savings averaged 0.05%. These results will be used to compare the performance of the sample of non-partnering projects with the partnering projects. Figures 8, 9, 10, 11, and 12 show a graphical representation of the data, organized in descending order, for each criterion shown in Table 6. Note that outlying data points in the figures are, in each case, from different projects.

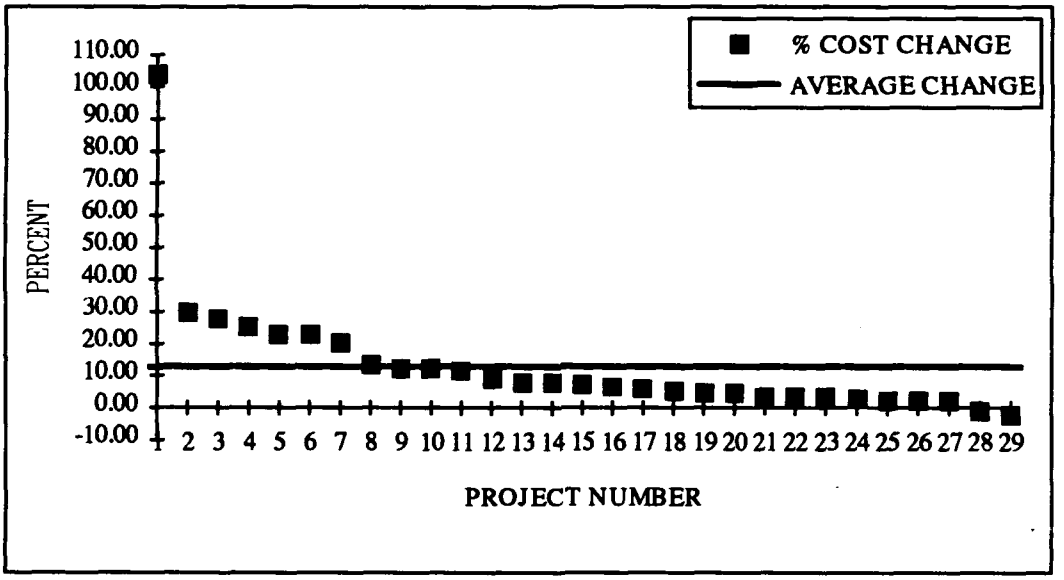

Figure 8. Non-Partnering Project % Cost Change

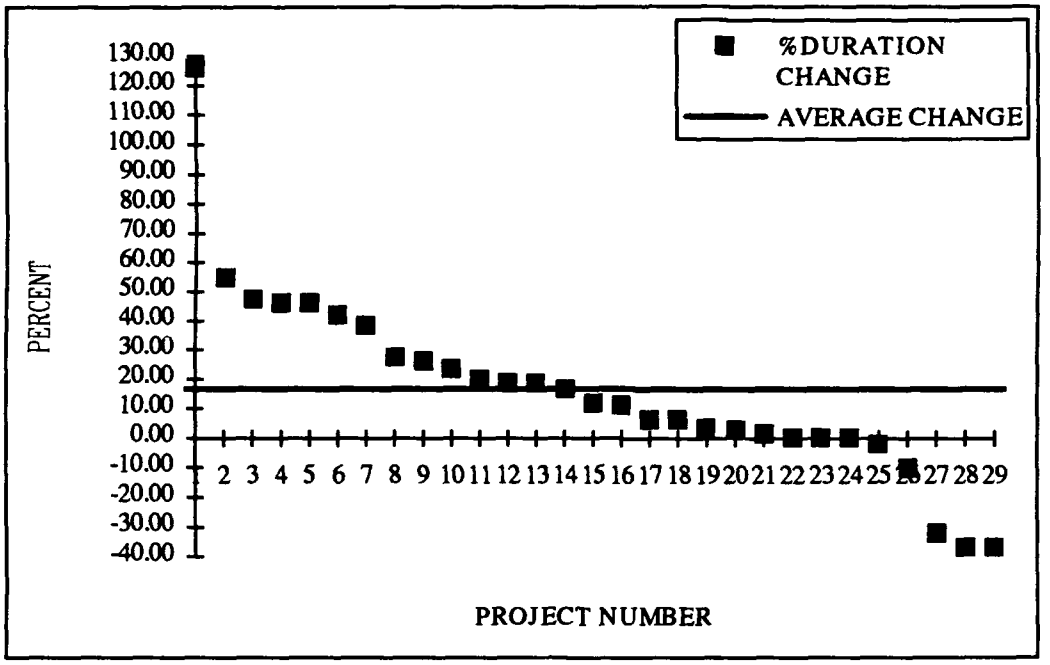

Figure 9. Non-Partnering Project % Duration Change

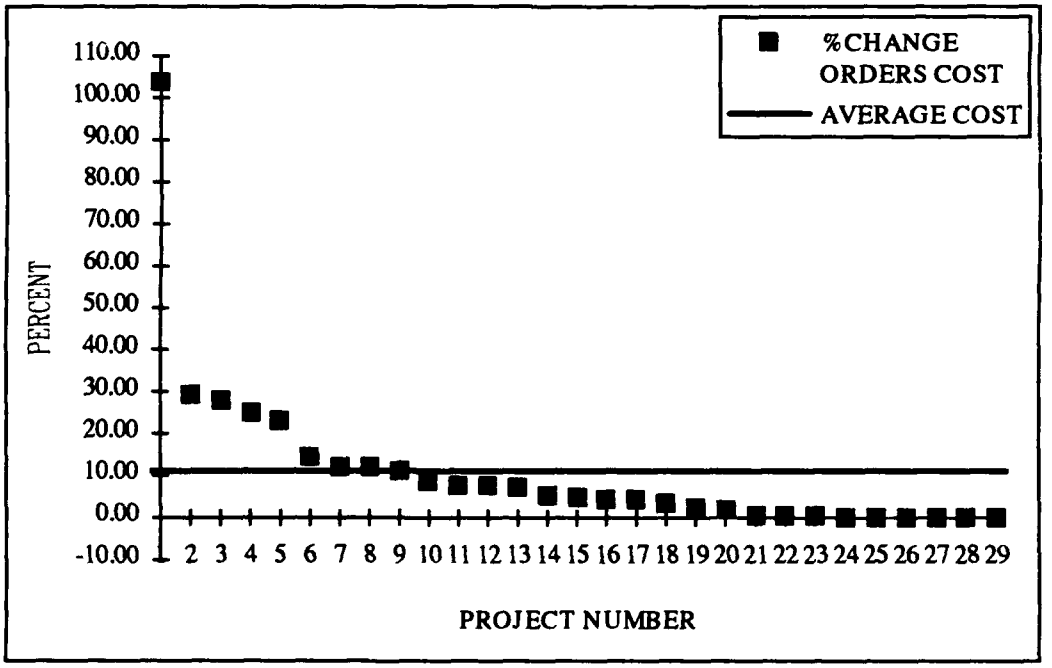

Figure 10. Non-Partnering Project % Change Orders Cost

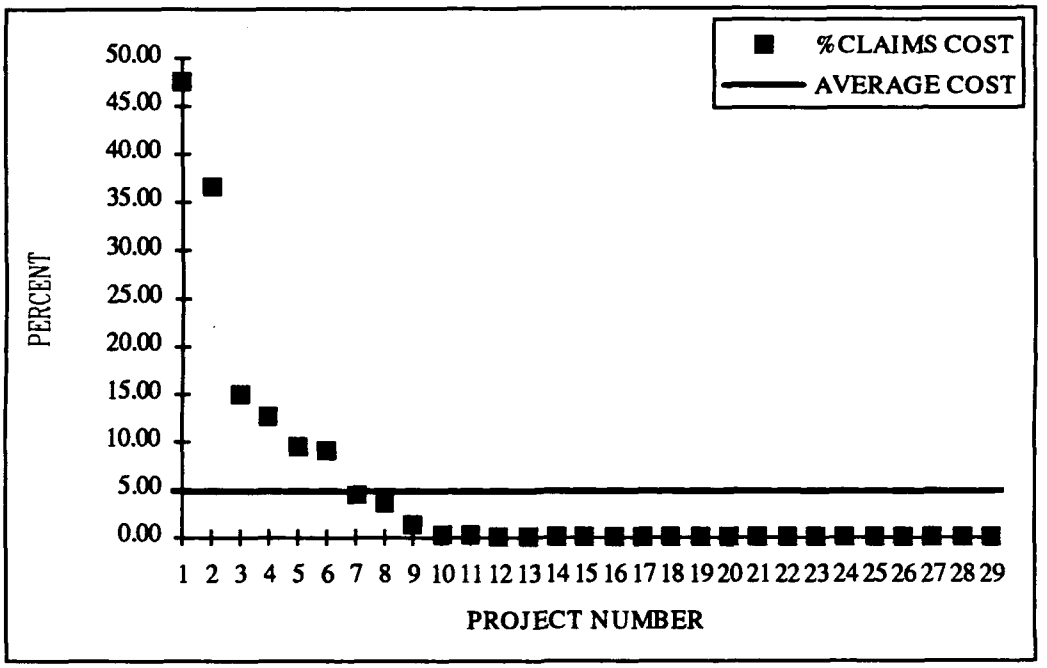

Figure 11. Non-Partnering Project % Claims Cost

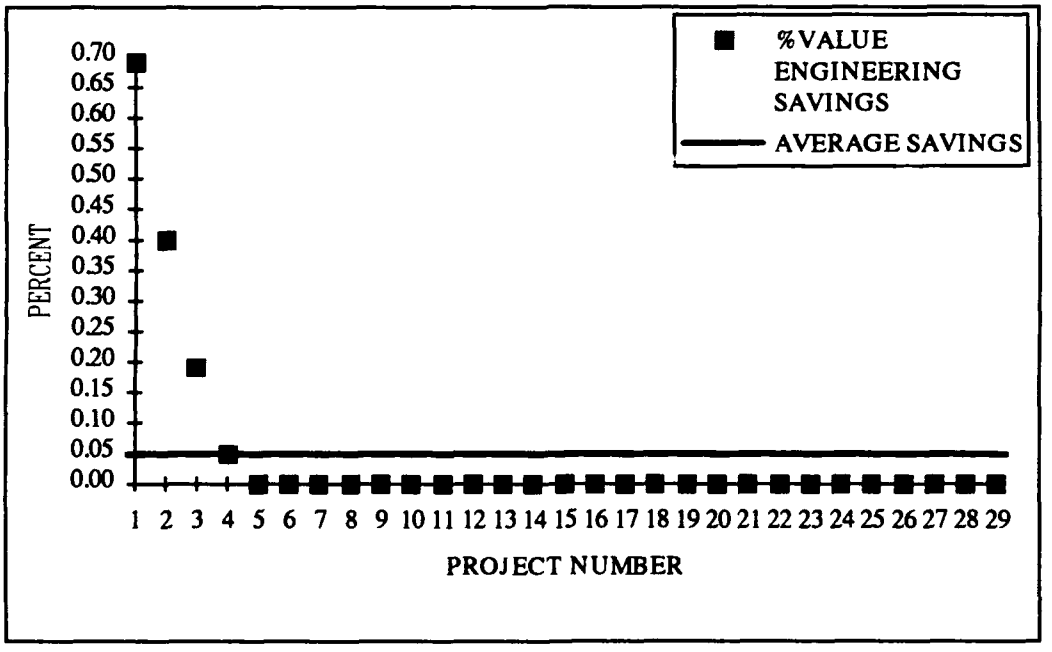

Figure 12. Non-Partnering Project % Value Engineering Savings

4.4. Subjective Data

Ten contractor and 15 Corps' project managers that had experience with partnering projects were confidentially interviewed to gauge their perceptions towards the value of the partnering relationship. Most interviews were conducted by telephone, with some information being received by letter. Questions asked included:

1. What are your views on the impact of partnering on project success?

2. Has partnering reduced, or eliminated, the adversarial relationships that normally exist between Corps and contractor representatives?

3. Are you satisfied with the partnering relationship? Are there shortcomings?

4. Does the partnering relationship aid in problem resolution?

5. Would you like to enter into partnering relationships on future projects with the Corps of Engineers?

It is interesting to note that none of the persons interviewed expressed negative comments about the partnering process, though they stressed the need for maintenance of the partnering relationship through follow-up meetings. Selected representative comments are listed below.

Corps Project Engineers:

"It is my opinion, based on progress to date, that the relationship developed and the forum established to resolve disputes/claims, etc., will help in keeping the overall project costs to a minimum."

"I feel that it will enhance the overall management for such an important endeavor. I think that the process will be instrumental in controlling cost and time growths while focusing on claims avoidance."

"The partnering concept, while not new, is a step in the right direction away from the spiraling levels of litigation and adversarial contractual relationships. It is clearly of mutual benefit to all parties."

Construction Contractors:

"We had initial success on a project partnered with the Navy, and as a result made the initial proposal for partnering on our current project with the Corps of Engineers."

"Partnering has led to lower overall costs, less time for performance, and a better working relationship between us and the Corps of Engineers."

"Before, there was no incentive to expend our effort on value engineering submittals. Under partnering, we feel that there is a more receptive atmosphere, making it more worth our while."

The results received by the author are similar to results of a more extensive survey conducted by Texas A&M University that asked if contractors and Corps' project engineers were satisfied with the results of their partnering experience. Of 89 contractors surveyed, 76.9% were satisfied with their partnering experience. Likewise, of 53 Corps' project managers surveyed, 76.5% were satisfied with their partnering experience (Rock 1992).

5. Analysis of Data

5.1. Comparison of Partnering and Non-Partnering Projects

The partnering and non-partnering projects will be compared based on the criteria of cost change, duration change, change orders cost, claims cost and value engineer savings. Figures 13, 14, 15, 16 and 17 show a graphical comparison of partnering projects versus non-partnering projects for each criterion.

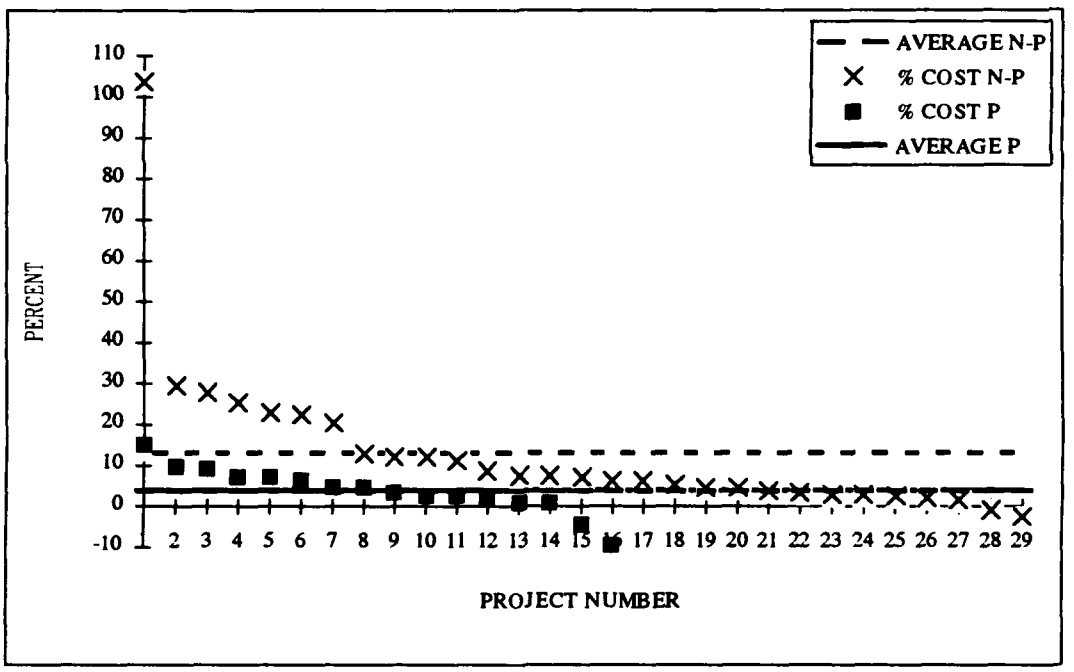

Figure 13. Partnering versus Non-Partnering % Cost Change

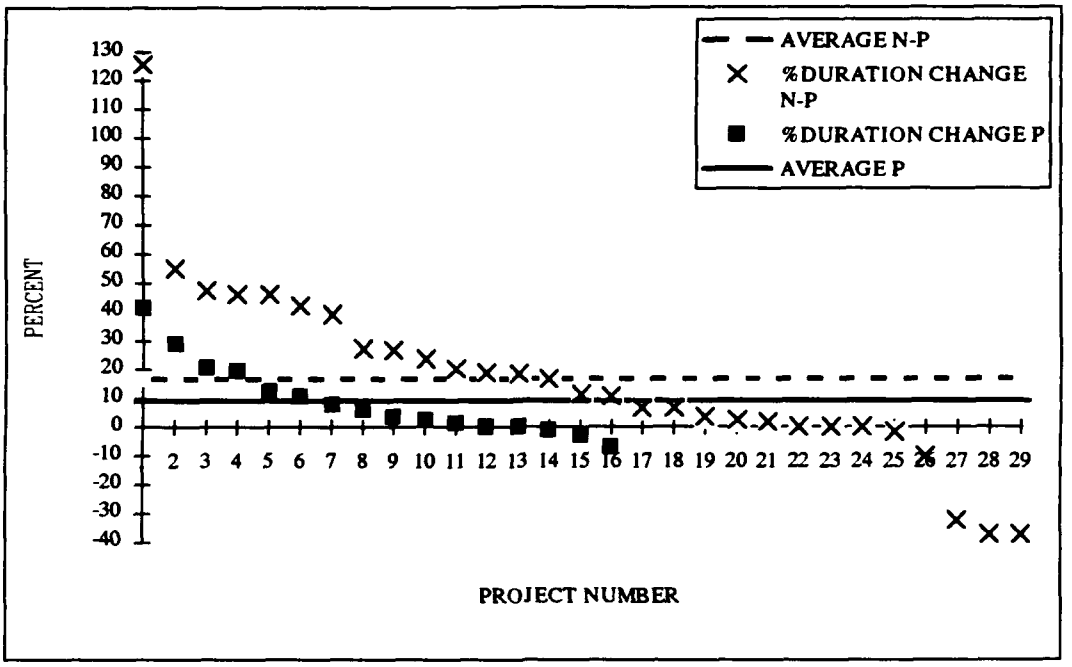

Figure 14. Partnering versus Non-Partnering % Duration Change

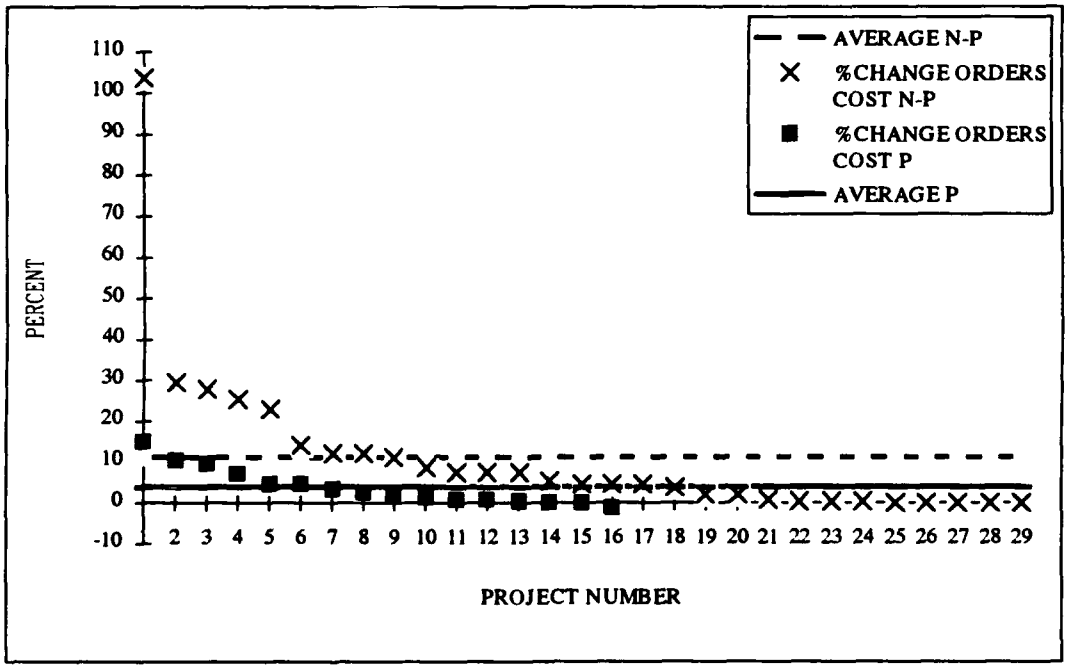

Figure 15. Partnering versus Non-Partnering % Change Orders Cost

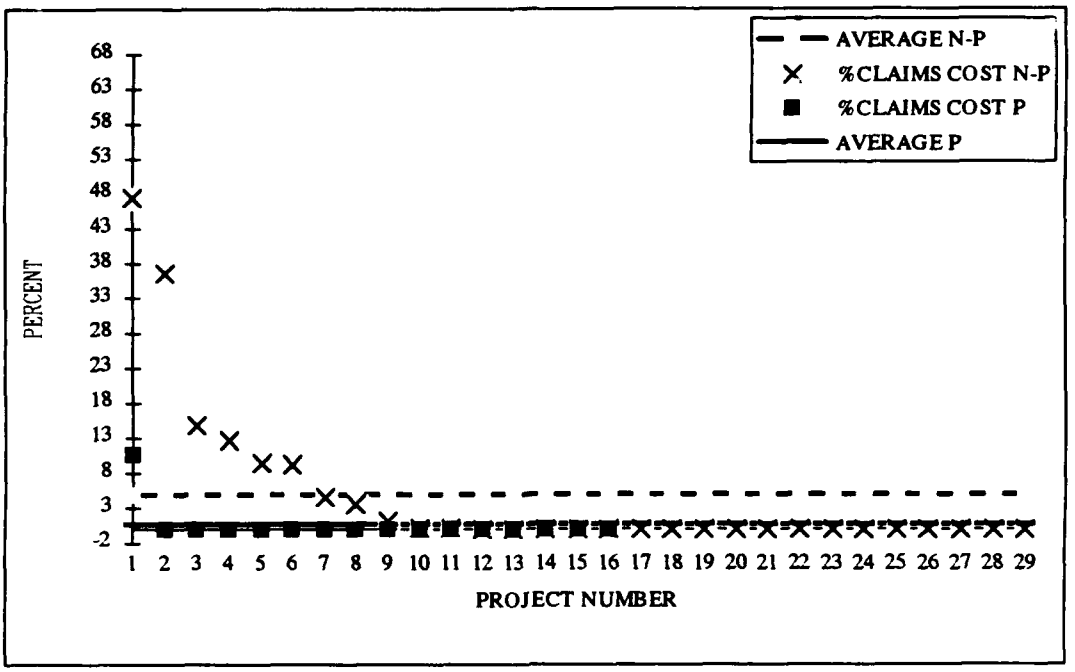

Figure 16. Partnering versus Non-Partnering % Claims Cost

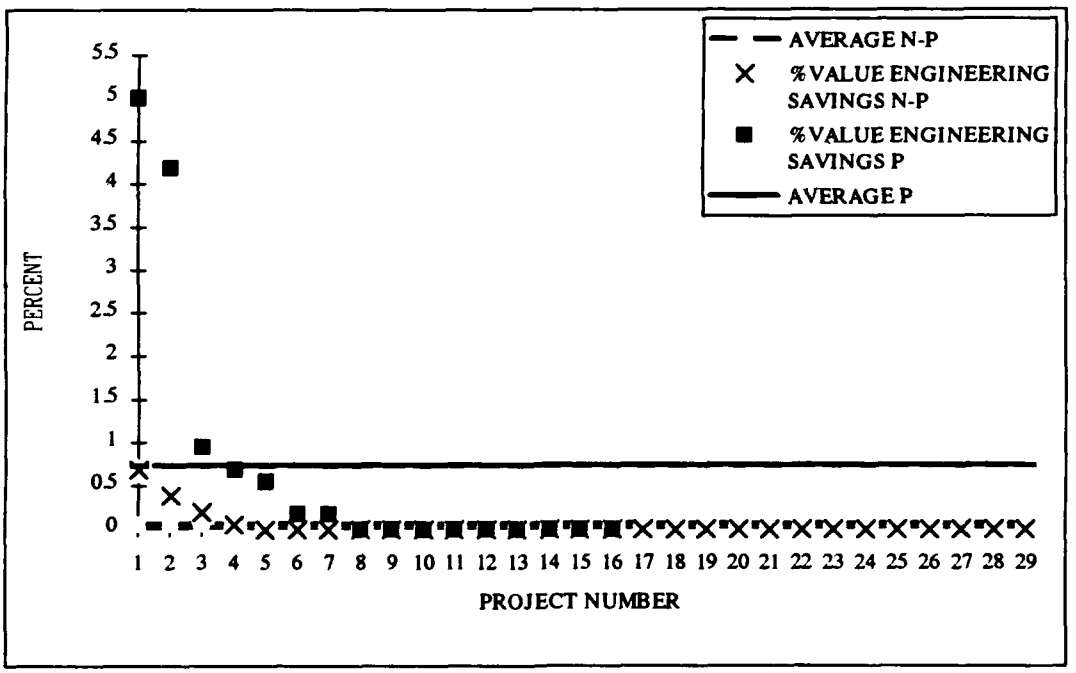

Figure 17. Partnering versus Non-Partnering % Value Engineering Savings

The average cost change for non-partnering projects is 12.98%. All but one (94%) of the partnering projects performed better than that average, with the one exception having a 15.17% cost change. The average cost change for partnering projects is 3.86%.

Twelve (75%) of the sixteen partnering projects performed better than the average duration change of 16.63% for the non-partnering projects. The average duration change for the partnering projects is 9.08%.

All but one (94%) of the partnering projects performed better than the average change orders cost of 11.06% for non-partnering projects. The average change orders cost for partnering projects is 3.90%.

All but one (94%) of the partnering projects performed better than the average claims cost of 4.86% for non-partnering projects. The average claims cost for partnering projects is 0.67%. There are only two claims (12.5%) in 16 partnering projects versus 9 claims (31%) in 29 non-partnering projects.

Seven (44%) of the sixteen partnering projects performed better than the average value engineering savings of 0.05% for non-partnering projects. The average value engineering savings for partnering projects is 0.73%. Seven (44%) of 16 partnering projects had some value engineering savings versus four (14%) of 29 non-partnering projects.

Table 7 shows the average performance for both partnering projects and non-partnering projects.

Table 7. Project Performance Comparison

(1)	PARTNERED N=16 (2)	NON-PARTNERED N=13 (3)	DIFFERENCE (NP TO P) (4)
MEAN COST CHANGE (%)	3.86	12.98	-9.12
MEAN SCHEDULE CHANGE (%)	9.08	16.63	-7.55
MEAN CHANGE ORDERS (%)	3.90	11.06	-7.16
MEAN CLAIMS COSTS (%)	0.67	4.86	-4.19
MEAN V. E. SAVINGS (%)	0.73	0.05	+0.68
MEAN CONTRACT AWARD PRICE	$10,238,156	$11,145,707	-$907,551

The results tend to show that partnering projects performed better on average than the sample of non-partnering projects in the categories of cost, schedule, change orders cost, claims cost and value engineering savings. The average contract award price for partnering projects is $10,238,156. The average for non-partnering projects is $11,145,707. Cost growth on partnering projects is 9.12% less than non-partnering projects, due in large part to a reduction in change orders cost of 7.55% and claims cost of 4.19%. Schedule growth is 7.55% less, and value engineering savings is 0.68% more. A graphical representation of these results is shown in Figure 18.

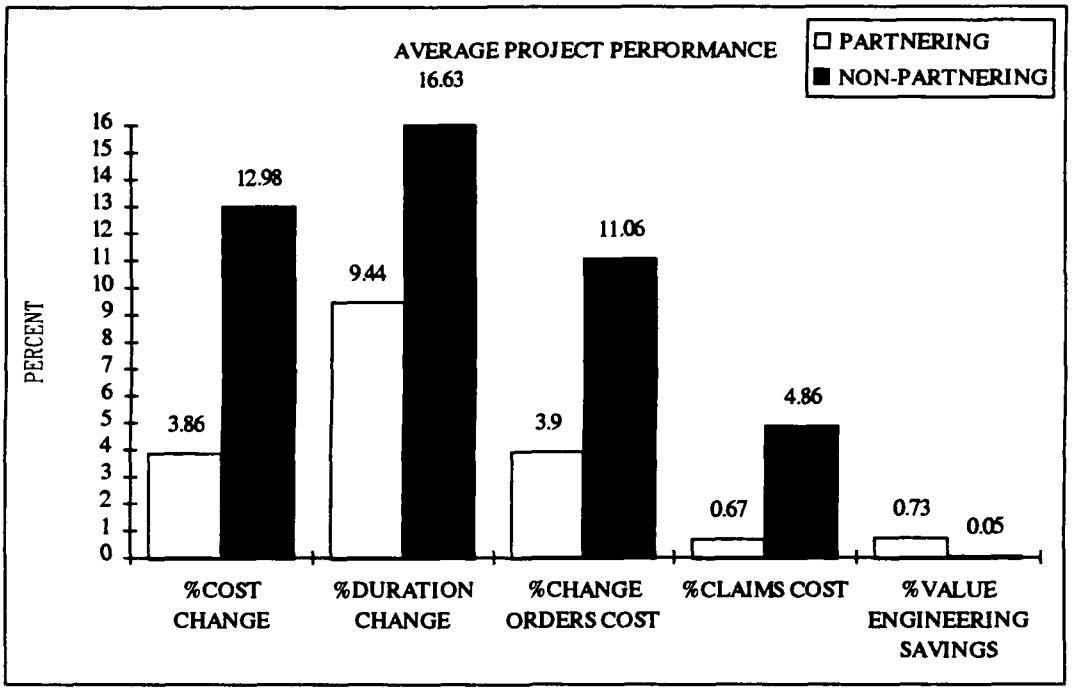

Figure 18. Project Performance Comparison

5.2. Analysis of Means

Though it is not possible to determine if the sample of non-partnering projects is representative of the Corps average project, the sample of partnering projects represents 85% of all completed projects to date, and is representative. Though the samples were not randomly drawn from the population of Corps of Engineers projects, an analysis of sample means, using the t-test, will give a good indication of whether the sample is statistically similar to the sample of partnering projects. The null hypothesis is that the sample means are equal. The results of the t-test, applied to the sample means for the average contract award price, % cost change, % duration change, % change orders cost, % claims cost, and % value engineering savings are shown in Table 8.

Table 8. Sample Means

CRITERIA (1)	PARTNERING MEAN (2)	NON-PARTNERING MEAN (3)	P(T<=t) TWO TAIL (4)
CONTRACT AWARD PRICE	$10,238,156	$11,145,707	0.7902
% COST CHANGE	3.86	12.98	0.0253
% DURATION CHANGE	9.08	16.63	0.2679
% CHANGE ORDERS COST	3.90	11.06	0.0729
% CLAIMS COST	0.67	4.86	0.0639
% VALUE ENGR SAVINGS	0.73	0.05	0.0611

The t-test results lead the author to reject the null hypothesis for every criteria except contract award price, indicating that the samples are statistically similar with respect to contract award price. Likewise, the samples are not similar with respect to the project performance criteria. This tends to validate the results of this study showing that partnering does have a positive impact on project performance in comparison to similar non-partnering projects.

5.3. Sample Variances

The sample variances are shown in Table 9.

Table 9. Sample Variances

CATEGORY (1)	%COST CHANGE (2)	%DURATION CHANGE (3)	%CHANGE ORDERS COST (4)	%CLAIMS COST (5)	%VALUE ENGR SAVINGS (6)
PARTNERING	30.59	155.76	19.33	6.61	2.24
NON-PARTNERING	369.62	975.80	381.54	121.25	0.02

Analysis of the above table shows that partnering projects appear to perform much more consistently in the areas of cost, duration, change orders cost, and claims cost. Though the value engineering savings of partnering projects have a greater variance than non-partnering projects, this is probably due to the fact that 86% of the non-partnering projects had no value engineering savings.

5.4. Subjective Data Analysis

Interviews with both contractor and Corps representatives suggest that for the most part their partnering experience has been beneficial. They point not only to the tangible measures listed above, but to certain intangibles, such as: (1) reduced administrative paperwork; (2) more enjoyable project work environment; (3) reduced communications barriers; and (4) less adversarial relationships. The need for follow-up partnering evaluation meetings or workshops was stressed to insure maintenance of the partnering relationship throughout the project duration. Districts have not measured their past project performance to determine control limits, which inhibits their efforts to quantify the impact of partnering.

6. Conclusion

Partnering is relatively new to the U. S. Army Corps of Engineers. Although it is not partnering in the traditional private sector sense, its tenets are being successfully implemented on a project-by-project basis. Eighty-four percent of the 37 domestic districts have completed or are involved in projects administered under a formal partnering agreement. Evidence that partnering is growing in the Corps of Engineers is supported by the fact that only 19 projects have been completed under a project partnering agreement since 1988, but 85 partnering projects are currently under construction or scheduled to begin soon. Some districts are using partnering on every project, while others are only using the concept on large, complex projects. Most of the effort is currently focused on construction contractor partnering. A few districts are partnering with other governmental agencies, and no districts are partnering with design firms.

Although it is not possible to determine if the sample of non-partnering projects accurately reflects the performance of the average Corps of Engineers project, the author is confident that the results shown in this study are indicative of the positive performance that would be expected on a project where the owner and contractor work together as a team, with no barriers to communication or problem resolution. The data for this study indicate that partnering appears to have a positive impact on project performance in terms of cost growth, schedule growth, change orders cost, claims cost and value engineering savings. The average cost growth for partnering projects is 3.86%, and is 9.12% less than the

average cost growth for the sample of non-partnering projects. This is largely attributable to an average reduction in change orders cost of 7.16%, and claims cost of 4.19%. Average schedule growth, from the original contract length, is 7.55% less for partnering projects, and value engineering savings are 0.68% more. It appears that those districts using formalized partnering agreements for their construction projects are able to deliver a finished facility at a lower cost and shorter duration than those that do not. It also appears that they have a more consistent project performance on partnering projects, which offers the potential for maintaining less contingency funds. When comparing the cost of partnering with the potential cost savings of 9.12%, partnering appears well worth the up-front investment. It allows for maximum facility construction in the face of future shrinking project funding.

A positive impact is also evident when talking to participants concerning the relationships between contractors and the Corps of Engineers. Interviews with both contractor and Corps representatives suggest that, for the most part, their partnering experience has been beneficial. They point to not only the tangible project performance measures, but to certain intangibles, such as reduced administrative paperwork, more enjoyable work environment, reduced communications barriers, and less adversarial relationships.

Billions of dollars are spent every year on construction projects financed by the public sector. The U. S. Army Corps of Engineers has demonstrated that the concepts of partnering are well suited for public sector project management.

If the cost savings indicated in this paper are indicative of future savings, then the overall benefit of partnering to all public sector projects is immense.

7. Recommendations

7.1. Actions Based on Analysis of Research

The results of this study indicate that the Corps of Engineers is progressing in the right direction with respect to partnering implementation. The following recommendations are offered:

- The Corps of Engineers should continue to encourage the application of partnering to projects with a contract cost within the range of this study, ($1-33 million). The Corps should expand this study to determine partnering's applicability to larger projects.
- The Corps of Engineers should measure its Corps-wide project performance to determine its average project performance using the criteria of cost growth, schedule growth, change orders cost, claims cost, and value engineering savings. Only after this has been done, will the Corps be able to assess quantitatively the impact of partnering and other quality management initiatives.
- Other federal and state public agencies need to consider the positive impacts from partnering and analyze them for use on their projects as well.
- The Corps of Engineers should use this study as an educational source for encouraging the spread of partnering throughout all districts, particularly those that are not currently involved in partnering.

7.2. Recommendations for Future Research

With only 19 projects completed at the time of this study, the findings are preliminary at best. Currently, there are 85 projects ongoing with most scheduled for completion in the next two to three years. Upon completion, there will be more than 100 partnering projects that will allow for a more accurate assessment of the impact of partnering. It is therefore recommended that another study be completed at that time. Other recommendations for future research follow:

- The Corps' partnering program should continue to expand to include partnering agreements with project customers (agencies) in an effort to improve scope definition, permitting processes, and end-user satisfaction.
- Partnering relationships with design firms should be pursued as well, in order to possibly foster cost savings and quality improvement during the detailed design phase of a project.

APPENDICES

Appendix A: Project Partnering Agreements

A.1. Partnering Agreement with Construction Contractors (Mobile 1992)

The PARTNERING AGREEMENT of the TEAM
for the OLIVER LOCK & DAM Replacement Project

I. We, the Mobile District Army Corps of Engineers and the Fru Con Corporation are committed to a positive utilization of **TEAMWORK** in the construction and contract administration of this project. We believe that through **TEAMWORK** we will be able to provide a *safe, quality* project completed *on time* and *within budget*.

II. We are committed to the concept of prompt, equitable **PROBLEM SOLVING** recognizing the individual interests and the common goals, such as 120 day cycle time for problem resolution. We firmly believe that by open, trustful and objective communication, our **PROBLEM SOLVING** can be done predominately in anticipation and prevention thereby ensuring the success for all team members. Early identification, open communication along with principled negotiations are the tenets of our PROBLEM SOLVING commitment.

III. We believe that this **PARTNERING** commitment will enable all team members to improve and expand their job performance. Further, we are committed to **SHARING AND TRANSFERRING** these partnering characteristics of **TEAM WORK AND PROBLEM SOLVING** with and to all people associated with the **OLIVER LOCK & DAM** Project to enhance their participation and to achieve maximum success in all respects.

QUALITY
SAFETY
ON TIME
INDIVIDUAL GROWTH
WITHIN BUDGET

CONCUR
MANFRED LUPP
Chairman and CEO, Fru-Con

CONCUR
LARRY S. BONINE
Colonel, US Army, C of E

PARTNERING AGREEMENT

FOR MANAGEMENT OF THE UPPER MINNESOTA RIVER MAINSTEM FROM GRANITE FALLS TO BIGSTONE LAKE

RECEIVED
MAY 7 1991
DNR NEW ULM

We, as partners, agree to cooperatively participate in the development and implementation of integrated natural resource management strategies for the Upper Minnesota River mainstem from Granite Falls to Bigstone Lake.

GOALS

I. Cooperatively identify conditions, needs, constraints, and opportunities in resource management on the Upper Minnesota River.

II. Encourage public participation in program development and implementation.

III. Develop strategies for the integrated management of Upper Minnesota River resources.

IV. Implement developed strategies within agency authorities and budgets.

We acknowledge the dynamic nature of the Upper Minnesota River and agree to meet again within three years to review our common goals and modify them, if necessary, to better serve the resource.

James C. Gritman, Regional Director, Region 3
U.S. Fish and Wildlife Service

Col. Roger L. Baldwin, District Engineer
St. Paul District Corps of Engineers

Rod W. Sando, Commissioner
Minnesota Department of Natural Resources

Charles W. Williams, Commissioner
Minnesota Pollution Control Agency

May 2, 1991

PARTNERING AGREEMENT

Horace To West Fargo Flood Control Project

We, the partners involved in the Horace To West Fargo Flood Control Project, agree to work together as a cooperative team to produce a quality project, on time, safely and within budget, so that all are proud to contribute.

GOALS

I. Complete the project so that it meets the design intent.

II. Resolve disagreements amicably through negotiations or other alternative dispute resolution techniques and avoiding costly litigation.

III. Avoid injuries, particularly lost time injuries.

IV. Provide for fair and equitable treatment of all concerns involved or affected by the project.

V. Finish project six months ahead of schedule.

SE Cass Water Resource District

Riley Bros. Construction, Inc.

1 November 1990
Date

St. Paul District, Corps of Engineers

Appendix B: Partnering Policy Memorandum

(Krull 1992)

DEPARTMENT OF THE ARMY
U.S Army Corps of Engineers
WASHINGTON, D.C 20314-1000

REPLY TO
ATTENTION OF:

CEMP-ZA 18 February 1992

COMMANDER'S POLICY MEMORANDUM # 16

SUBJECT: Partnering

1. The U.S. Army Corps of Engineers has traditionally sought to accomplish its missions in the most effective and efficient manner possible, and to explore better ways to do our business. In Our Vision, we pledged to forge improved relationships across a broad spectrum. One innovation that has proven successful in improving our performance during the past few years is "partnering" with construction contractors. While our past efforts have been primarily directed toward improving relationships with construction contractors, the principles of partnering can and must be applied to every internal and external customer, cost sharing partner, and contractor or issue we deal with. Relationships between project management and functional elements within a district, between districts and customers and between contracting officers and architect engineers are typical of those interactions in which we will work to minimize time consuming and costly disputes and facilitate communication for the benefit of all. The essence of partnering is promoting a cooperative attitude and the active pursuit of common goals by the parties involved.

2. Because partnering develops positive and mutually beneficial relationships, it creates a climate characterized by trust and cooperation. It creates a relationship between two or more parties and promotes teamwork. Partnering seeks to eliminate the "us" versus "them" mentality, and to form a "we" approach for the mutual benefit of the project user, the taxpayers, and the contractor. THEREFORE, IT IS THE CLEAR POLICY OF THE CORPS OF ENGINEERS TO DEVELOP, PROMOTE AND PRACTICE PARTNERING ON ALL CONSTRUCTION CONTRACTS, AND TO UNIVERSALLY APPLY THE CONCEPT TO ALL OTHER RELATIONSHIPS.

3. During the next few months, our headquarters will publish guidance and lessons learned to further our understanding and promote the implementation of partnering. All members of our team should apply the principles of partnering at every appropriate opportunity and across every facet and activity of our organization, both internally and externally.

H. J. Hatch
Lieutenant General, USA
Commanding

Appendix C: Solicitation Letter

January 28, 1992

Dear Sir,

I am currently assigned as a graduate student at the University of Texas at Austin, in the Department of Civil Engineering's Construction Engineering and Project Management program. As part of my studies, I am doing research on the Corps of Engineers' recent switch to a partnering concept for their construction contracts requiring pre-project team building workshops between Corps and contractor representatives to establish common project objectives.

I am interested in the cost impact that this approach is having on projects and am therefore requesting information from the districts that have undertaken such projects. In particular, I am searching for data on completed projects that reflects the bid price, actual completion cost, change order costs, team building workshop costs, claim costs, scheduled completion date and actual completion date. Additionally, I am looking for similar data for other projects that were completed prior to implementation of the partnering approach to serve as a comparison.

This research is of interest to the University of Texas and should be of interest to the Corps of Engineers as well. I would greatly appreciate your assistance in providing me with a point of contact in your headquarters that would be able to provide the data that I am searching for.

My mailing address and phone number are listed below. Thank you for your assistance.

Respectfully,

DAVID C. WESTON
CPT, EN
Graduate Student

School Address:
CPT David C. Weston
Graduate Student, ECJ 5.200
College of Engineering (CEPM)
University of Texas
Austin, TX 78712
(512) 471-4648

Home: CPT David C. Weston
2512 Charla Cir
Austin, TX 78728
(512) 990-5572

Appendix D: Partnering Project Data

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	AIRCRAFT MAINTENANCE FACILITY	DACA47-90-C-0043
	PROJECT COST	PROJECT DURATION
ORIGINAL	$12,655,385	300
FINAL	$12,884,402	323
% CHANGE	1.81%	7.67%
	CHANGE ORDERS	CLAIMS
COST	$13,750	$11,000
% PROJECT	0.11%	0.09%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	CORROSION CONTROL FACILITY	DACA47-91-C-0003
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,058,000	300
FINAL	$5,385,426	387
% CHANGE	6.47%	29.00%
	CHANGE ORDERS	CLAIMS
COST	$19,650	$0
% PROJECT	0.39%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	SQUADRON OPS FACILITY	DACA47-91-C-0005
	PROJECT COST	PROJECT DURATION
ORIGINAL	$4,657,212	340
FINAL	$4,870,402	376
% CHANGE	4.58%	10.59%
	CHANGE ORDERS	CLAIMS
COST	$12,800	$0
% PROJECT	0.27%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
HUNTINGTON	LOCK AND GATE BAY-PHASE I	DACW69-90-C-0017
	PROJECT COST	PROJECT DURATION
ORIGINAL	$15,575,000	523
FINAL	$15,683,265	509
% CHANGE	0.70%	-2.68%
	CHANGE ORDERS	CLAIMS
COST	$194,292	$1,656,101
% PROJECT	1.25%	10.63%
	VALUE ENGINEERING	PROJECT TYPE
COST	$86,027	CIVIL
% PROJECT	0.55%	

(Butler 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
JACKSONVILLE	LEVEES 74 & 74N	DACW17-89-C-0046
	PROJECT COST	PROJECT DURATION
ORIGINAL	$8,323,045	720
FINAL	$8,717,169	810
% CHANGE	4.74%	0.89%
	CHANGE ORDERS	CLAIMS
COST	$394,123	$0
% PROJECT	4.74%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Pettijohn 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
MEMPHIS	HARBOR CONSTRUCTION PHASE I	DACW66-89-C-0131
	PROJECT COST	PROJECT DURATION
ORIGINAL	$1,551,340	656
FINAL	$1,786,678	680
% CHANGE	15.17%	3.66%
	CHANGE ORDERS	CLAIMS
COST	$235,338	$0
% PROJECT	15.17%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Roland 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
PORTLAND	DIAPHRAGM WALL	UNKNOWN
	PROJECT COST	PROJECT DURATION
ORIGINAL	$33,900,000	730
FINAL	$36,300,000	730
% CHANGE	7.08%	0.00%
	CHANGE ORDERS	CLAIMS
COST	$2,400,000	$0
% PROJECT	7.08%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$1,700,000	CIVIL
% PROJECT	5.01%	

(Savidge 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
PORTLAND	HATCHERY WELL REPLACEMENT	UNKNOWN
	PROJECT COST	PROJECT DURATION
ORIGINAL	$4,990,000	457
FINAL	$4,760,000	426
% CHANGE	-4.61%	-6.78%
	CHANGE ORDERS	CLAIMS
COST	$230,000	$0
% PROJECT	4.61%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$46,698	CIVIL
% PROJECT	0.94%	

(Savidge 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
SAVANNAH	SCHOOL OF AMERICAS	DACA21-89-C-0074
	PROJECT COST	PROJECT DURATION
ORIGINAL	$22,798,000	968
FINAL	$24,403,353	1028
% CHANGE	7.04%	6.20%
	CHANGE ORDERS	CLAIMS
COST	$230,000	$0
% PROJECT	1.01%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Farmer 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
SAVANNAH	OATS CREEK FLOOD CONTROL	DACA21-90-C-0031
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,748,520	540
FINAL	$5,805,690	646
% CHANGE	0.99%	19.63%
	CHANGE ORDERS	CLAIMS
COST	$57,170	$0
% PROJECT	0.99%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Farmer 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
WALLA WALLA	LGD FISH FACILITY PHASE I	DAC -89-C-10
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,356,000	*
FINAL	$5,867,383	*
% CHANGE	9.55%	0.00%
	CHANGE ORDERS	CLAIMS
COST	$511,383	$0
% PROJECT	9.55%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$9,552	CIVIL
% PROJECT	0.18%	

(Willard 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
WALLA WALLA	LGD FISH FACILITY PHASE II	DAC -89-C-27
	PROJECT COST	PROJECT DURATION
ORIGINAL	$3,321,250	*
FINAL	$3,400,960	*
% CHANGE	2.40%	1.56%
	CHANGE ORDERS	CLAIMS
COST	$65,531	$0
% PROJECT	1.97%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Willard 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
WALLA WALLA	CLEARWATER HATCHERY	DAC -89-C-40
	PROJECT COST	PROJECT DURATION
ORIGINAL	$15,471,840	*
FINAL	$14,017,488	*
% CHANGE	-9.40%	41.30%
	CHANGE ORDERS	CLAIMS
COST	($197,676)	$0
% PROJECT	-1.28%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$648,542	CIVIL
% PROJECT	4.19%	

(Willard 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
WALLA WALLA	UMATILLA HATCHERY	DAC -90-C-12
	PROJECT COST	PROJECT DURATION
ORIGINAL	$7,097,911	*
FINAL	$7,287,425	*
% CHANGE	2.67%	2.67%
	CHANGE ORDERS	CLAIMS
COST	$181,412	$0
% PROJECT	2.56%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$48,352	CIVIL
% PROJECT	0.68%	

(Willard 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
WALLA WALLA	CLEARWATER HATCHERY W/S	DAC -90-C-30
	PROJECT COST	PROJECT DURATION
ORIGINAL	$10,258,600	*
FINAL	$11,185,323	*
% CHANGE	9.04%	20.86%
	CHANGE ORDERS	CLAIMS
COST	$1,071,098	$0
% PROJECT	10.44%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$17,920	CIVIL
% PROJECT	0.17%	

(Willard 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
WALLA WALLA	LMD FISH BYPASS	DAC -91-C-02
	PROJECT COST	PROJECT DURATION
ORIGINAL	$7,049,000	*
FINAL	$7,292,895	*
% CHANGE	3.46%	-0.98%
	CHANGE ORDERS	CLAIMS
COST	$247,454	$0
% PROJECT	3.51%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Willard 1992)

Appendix E: Non-Partnering Project Data

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	TAXIWAY, APRONS, LIGHTING	DACA47-90-C-0035
	PROJECT COST	PROJECT DURATION
ORIGINAL	$4,938,000	210
FINAL	$4,892,528	268
% CHANGE	-0.92%	27.62%
	CHANGE ORDERS	CLAIMS
COST	$6,250	$0
% PROJECT	0.13%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	AIRCRAFT MAINTENANCE DOCK	DACA47-88-C-0017
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,739,250	540
FINAL	$6,109,700	603
% CHANGE	6.45%	11.67%
	CHANGE ORDERS	CLAIMS
COST	$22,230	$0
% PROJECT	0.39%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	AIRCRAFT FUEL SYSTEM DOCK	DACA47-89-C-0040
	PROJECT COST	PROJECT DURATION
ORIGINAL	$2,851,214	330
FINAL	$2,941,997	396
% CHANGE	3.18%	20.00%
	CHANGE ORDERS	CLAIMS
COST	$5,450	$0
% PROJECT	0.19%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	UEPH ALTERATION	DACA47-90-C-0018
	PROJECT COST	PROJECT DURATION
ORIGINAL	$4,312,364	720
FINAL	$4,416,624	740
% CHANGE	2.42%	2.78%
	CHANGE ORDERS	CLAIMS
COST	$6,260	$0
% PROJECT	0.15%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	MUNITIONS STORAGE COMPLEX	DACA47-88-C-0014
	PROJECT COST	PROJECT DURATION
ORIGINAL	$32,646,896	730
FINAL	$33,735,859	743
% CHANGE	3.34%	1.78%
	CHANGE ORDERS	CLAIMS
COST	$43,560	$4,167,590
% PROJECT	0.13%	12.77%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	TAINTER GATES, JMD	DACA47-91-C-0012
	PROJECT COST	PROJECT DURATION
ORIGINAL	$321,696	270
FINAL	$331,132	266
% CHANGE	2.93%	-1.48%
	CHANGE ORDERS	CLAIMS
COST	$1,000	$0
% PROJECT	0.31%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	TEST FACILITY	DACA47-88-C-0010
	PROJECT COST	PROJECT DURATION
ORIGINAL	$3,539,944	300
FINAL	$4,005,950	357
% CHANGE	13.16%	19.00%
	CHANGE ORDERS	CLAIMS
COST	$27,960	$0
% PROJECT	0.79%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
ALBUQUERQUE	UEPH ALTERATION 89	DACA47-89-C-0024
	PROJECT COST	PROJECT DURATION
ORIGINAL	$2,866,500	400
FINAL	$3,042,199	467
% CHANGE	6.13%	16.75%
	CHANGE ORDERS	CLAIMS
COST	$10,550	$131,070
% PROJECT	0.37%	4.57%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Maestas 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
BUFFALO	MAUMEE BAY STATE PARK	90-B-0026
	PROJECT COST	PROJECT DURATION
ORIGINAL	$2,063,590	655
FINAL	$2,311,664	395
% CHANGE	12.02%	-39.69%
	CHANGE ORDERS	CLAIMS
COST	$248,074	$0
% PROJECT	12.02%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Kumor 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
BUFFALO	PORT ONTARIO HARBOR	86-B-31
	PROJECT COST	PROJECT DURATION
ORIGINAL	$2,084,290	655
FINAL	$2,563,970	395
% CHANGE	23.01%	-39.69%
	CHANGE ORDERS	CLAIMS
COST	$479,680	$0
% PROJECT	23.01%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Kumor 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
BUFFALO	SMALL BOAT HARBOR	88-B-0025
	PROJECT COST	PROJECT DURATION
ORIGINAL	$3,333,000	18
FINAL	$4,084,395	25
% CHANGE	22.54%	38.89%
	CHANGE ORDERS	CLAIMS
COST	$252,395	$499,000
% PROJECT	7.57%	14.97%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Kumor 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
BUFFALO	ELLICOT CR, STAGE2	88-B-0002
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,194,469	224
FINAL	$5,587,360	239
% CHANGE	7.56%	6.70%
	CHANGE ORDERS	CLAIMS
COST	$392,891	$499,000
% PROJECT	7.56%	9.61%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Kumor 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
BUFFALO	ELLICOT CR, STAGE2A	88-B-0003
	PROJECT COST	PROJECT DURATION
ORIGINAL	$1,359,515	150
FINAL	$1,433,536	150
% CHANGE	5.44%	0.00%
	CHANGE ORDERS	CLAIMS
COST	$74,021	$499,000
% PROJECT	5.44%	36.70%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Kumor 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
BUFFALO	WEST HARBOR	88-B-0021
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,627,520	41
FINAL	$5,897,696	60
% CHANGE	4.80%	46.34%
	CHANGE ORDERS	CLAIMS
COST	$270,176	$0
% PROJECT	4.80%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Kumor 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
FORT WORTH	COMPOSITE MEDICAL FACILITY	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$33,706,326	1245
FINAL	$37,503,574	1769
% CHANGE	11.27%	42.09%
	CHANGE ORDERS	CLAIMS
COST	$3,797,248	$16,000,000
% PROJECT	11.27%	47.47%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(Mills 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
HUNTINGTON	FLOOD WALL/PUMP STATION	69-88-C-0041
	PROJECT COST	PROJECT DURATION
ORIGINAL	$41,887,000	1620
FINAL	$42,656,535	1729
% CHANGE	1.84%	6.73%
	CHANGE ORDERS	CLAIMS
COST	$958,105	$0
% PROJECT	2.29%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$288,570	CIVIL
% PROJECT	0.69%	

(Butler 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
HUNTINGTON	DAM AND APTS PHASE 2	69-86-C-W039
	PROJECT COST	PROJECT DURATION
ORIGINAL	$24,640,375	1800
FINAL	$27,604,765	1800
% CHANGE	12.03%	0.00%
	CHANGE ORDERS	CLAIMS
COST	$2,977,170	$0
% PROJECT	12.08%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$12,780	CIVIL
% PROJECT	0.05%	

(Butler 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
JACKSONVILLE	LEVEE 75 AND STRUCTURE 5	DACW17-90-C-0088
	PROJECT COST	PROJECT DURATION
ORIGINAL	$2,883,735	540
FINAL	$2,940,579	600
% CHANGE	1.97%	11.11%
	CHANGE ORDERS	CLAIMS
COST	$56,844	$0
% PROJECT	1.97%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Pettijohn 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
LITTLE ROCK	HAZARDOUS WASTE FACILITY	DACA56-84-C-0016
	PROJECT COST	PROJECT DURATION
ORIGINAL	$4,666,000	850
FINAL	$9,515,000	1254
% CHANGE	103.92%	47.53%
	CHANGE ORDERS	CLAIMS
COST	$4,849,000	$0
% PROJECT	103.92%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(McCloskey 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
LITTLE ROCK	AMMUNITION WORKSHOP	DACA03-88-C-0013
	PROJECT COST	PROJECT DURATION
ORIGINAL	$1,708,000	365
FINAL	$1,860,000	534
% CHANGE	8.90%	46.30%
	CHANGE ORDERS	CLAIMS
COST	$152,000	$0
% PROJECT	8.90%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(McCloskey 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
LITTLE ROCK	GYMNASIUM	DACA03-88-C-0020
	PROJECT COST	PROJECT DURATION
ORIGINAL	$2,359,000	540
FINAL	$2,445,000	640
% CHANGE	3.65%	18.52%
	CHANGE ORDERS	CLAIMS
COST	$86,000	$0
% PROJECT	3.65%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(McCloskey 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
LITTLE ROCK	ALTERNATE TAXIWAYS	DACA03-87-C-0011
	PROJECT COST	PROJECT DURATION
ORIGINAL	$1,764,000	240
FINAL	$2,210,000	542
% CHANGE	25.28%	125.83%
	CHANGE ORDERS	CLAIMS
COST	$446,000	$0
% PROJECT	25.28%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(McCloskey 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
LITTLE ROCK	1600M USARC-MCA/OMA	DACA03-87-C-0010
	PROJECT COST	PROJECT DURATION
ORIGINAL	$5,770,000	720
FINAL	$6,213,000	890
% CHANGE	7.68%	23.61%
	CHANGE ORDERS	CLAIMS
COST	$435,000	$0
% PROJECT	7.54%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	MILITARY
% PROJECT	0.00%	

(McCloskey 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
NEW ORLEANS	FRESH WATER DIVERSION	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$15,884,618	899
FINAL	$15,530,810	899
% CHANGE	-2.23%	0.00%
	CHANGE ORDERS	CLAIMS
COST	($6,921)	$41,369
% PROJECT	-0.04%	0.26%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Hill 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
NEW ORLEANS	PUMPING STATION	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$15,424,900	904
FINAL	$16,550,722	940
% CHANGE	7.30%	3.98%
	CHANGE ORDERS	CLAIMS
COST	$694,220	$199,000
% PROJECT	4.50%	1.29%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Hill 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
NEW ORLEANS	GOLDEN MEADOW FLOODGATE	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$7,369,305	734
FINAL	$8,885,502	1139
% CHANGE	20.57%	55.18%
	CHANGE ORDERS	CLAIMS
COST	$1,063,328	$275,000
% PROJECT	14.43%	3.73%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Hill 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
NEW ORLEANS	LAROSE FLOODGATE	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$3,744,000	1186
FINAL	$4,786,836	1502
% CHANGE	27.85%	26.64%
	CHANGE ORDERS	CLAIMS
COST	$1,042,836	$0
% PROJECT	27.85%	0.00%
	VALUE ENGINEERING	PROJECT TYPE
COST	$0	CIVIL
% PROJECT	0.00%	

(Hill 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
PORTLAND	SEDIMENT RETENTION STRUCTURE	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$56,490,000	1611
FINAL	$73,190,000	1095
% CHANGE	29.56%	-32.03%
	CHANGE ORDERS	CLAIMS
COST	$16,700,000	$5,180,000
% PROJECT	29.56%	9.17%
	VALUE ENGINEERING	PROJECT TYPE
COST	$105,625	CIVIL
% PROJECT	0.19%	

(Savidge 1992)

DISTRICT	PROJECT NAME	CONTRACT NO.
PORTLAND	LOCK EXCAVATION	*
	PROJECT COST	PROJECT DURATION
ORIGINAL	$28,050,000	946
FINAL	$29,360,000	853
% CHANGE	4.67%	-9.83%
	CHANGE ORDERS	CLAIMS
COST	$1,310,000	$90,000
% PROJECT	4.67%	0.32%
	VALUE ENGINEERING	PROJECT TYPE
COST	$113,209	CIVIL
% PROJECT	0.40%	

(Savidge 1992)

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